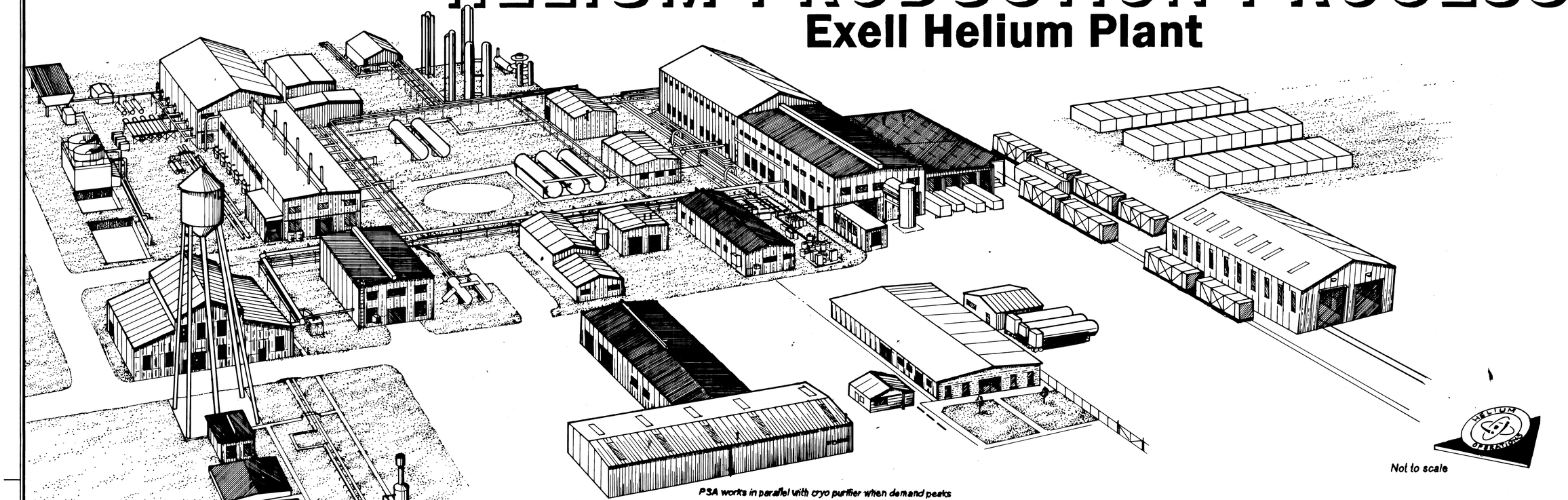
HELIUM PRODUCTION PROCESS

Exell Helium Plant



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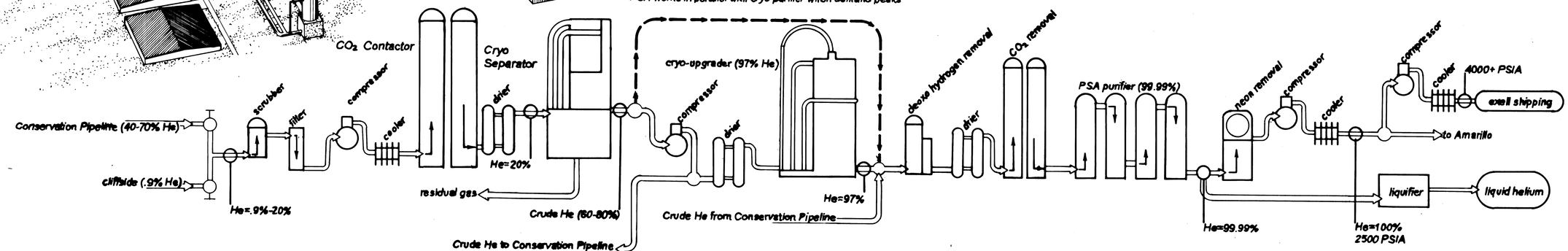

Since 1943 the Exell Plant derived its helium-rich natural gas from the Panhandle gas field in Texas. In accordance with the helium conservation program, initiated in 1962. Exell first produced crude helium (about 70% purity).

Beginning in 1966, the Cliffside gas, about .9percent helium in raw natural gas was blended with 60-70%crude helium from the conservation pipeline and entered the Exell plant on the northeast corner of the grounds to undergo the first step in the process-gas treatment. Here the raw gas was scrubbed to remove liquid hydrocarbon contaminants, then sent to Carbon Dioxide(CO_2)removal units. At this point, the gas contained about 20-25% helium.

The gas was then pumped to the Cryogenic Separation units where a series of heat exchangers were used to remove contaminant gases such as methane, hydrogen, oxygen, and nitrogen. Nitrogen proved to be crucial in the process because it served to cool the incoming gas. The resulting product, known as "crude", contained 60-80% helium.

By the 1970s, a second cryogenic separator (Unit II) was added. This unit produced crude helium of 75-80% purity containing only traces of nitrogen, hydrogen, and neon. The crude helium, then, was sent either through the purification process or pumped back into the conservation pipeline and ultimately back into the Cliffside field for storage and conservation.

At the purification stage, several different processes were adopted. The earliest applications of cryogenic purification used a system of heat exchangers to remove the remaining contaminant gasses from the crude helium resulting in a 98.5% pure product. In 1946 the refrigerated charcoal process developed at Amarillo was implemented at Exell The addition of the charcoal pots to the cryo-purifiers resulted in a new 99.995% pure product known as "Grade A" helium. In the late 1970's the bureau replaced the original equipment with more efficient cryo-purifiers manufactured by the Helix Corporation.

In the late 1970's, Exell added a new purifier called a Pressure Swing Adsorption unit (PSA), manufactured by the Hudson Engineering Company. This device separated helium from other gases through pressure and molecular exchanges rather than the cryogenic process. The introduction of the PSA required several modifications to the Exell plant's configuration. In normal production the Helix cryo-purifiers were used to upgrade crude helium to 97% purity. Due to the increased capacity of the purification process the plant could now reintroduce crude helium from the conservation pipeline. However this necessitated the introduction of a secondary CO_2 contactor to remove trace amounts of contaminants from the conservation gas. The mixture of 97% pure and crude helium was then sent to the deoxo units and finally to the PSA to produce a 99.999% pure product. When the demand for Grade A helium peaked, the plant reconfigured to operate the PSA and the Helix cryo-purifiers in parallel. The result was an increased production capacity of 100% pure helium.

When industry uses demanded 100% pure helium, the purification process included neon removal. The Neon Removal Unit supercooled the helium gas to -400° Fahrenheit to remove the remaining traces of neon. This process resulted in 100% helium. The pure helium was then either loaded into rail tank cars or semi trailers, or piped to the Amarillo plant for shipping. Beginning in the 1960s, shippers liquified some of the helium to reduce transportation costs.

Exell's technology evolved in three stages. Initially, the plant used cryogenic processing without charcoal filtering. In 1946 the refrigerated charcoal filtering process developed at Amarillo was implemented at Exell resulting in 99.995 percent helium purity (Grade A)by 1949. For the remainder of the 1960s, Bureau of Mines engineers designed the cutting edge technology used to produce the strategic, inert gas.

By the 1970s, however, private helium companies, the chief beneficiaries from earlier federal technological discoveries and from federal purchase of their helium, produced an even more advanced technology. As a result, the federal helium program in the 1970s to the 1990s purchased its latest processing machinery and equipment from private firms.

From 1917 through the 1960s, the federal helium program clearly set the technological pace for the entire industry. By the 1970s, however, in part because of the mandated federal purchase of privately produced helium, private companies soon displaced the federal program in the manufacture of state-of-the-art helium processing technology.

DELINEATED BY: Lucas Dupuis 2001

HELIUM ACTIVITIES RECORDING PROJECT
NATIONAL PARK SERVICE
UNITED STATES DEPARTMENT OF THE INTERIOR

U.S. BUREAU OF MINES, HELIUM PLANTS, EXELL HELIUM PLANT 1943
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